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Zero Retries is an independent newsletter about technological innovation in Amateur Radio. Zero Retries promotes Amateur Radio as (literally) a license to experiment with radio technology.

About Zero Retries

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Request To Send

ARDC Notes and DLARC Notes
I mention Amateur Radio Digital Communications (ARDC) and Digital Library of Amateur Radio & Communications (DLARC) frequently here in Zero Retries. Enough so that it makes sense to me to make ARDC Notes and DLARC Notes at least an occasional feature, and perhaps a regular feature. Both ARDC and DLARC publish updates on their respective activities, but both have very broad activities, not all of which I consider Zero Retries Interesting. Because both ARDC and DLARC contribute significantly to Technological Innovation in Amateur Radio, I think there's value in highlighting some Zero Retries Interesting activities in both on a regular basis. This issue features the first (formal) installment of DLARC Notes.

Administrivia - "In this issue" items now linkable (post publication)

Substack recently added automatic generation of unique URLs for major headings within a Substack newsletter (or page) *after* it's published. I'll now add these internal links during my usual post-publication cleanup of goofs and typos, but unfortunately those links won't be in the email edition. See Zero Retries 0085 for an example.

Zero Retries 0085 Poll - ARRL Membership?
73% of the 81 readers (~ 11% of total readership) who took the Zero Retries 0085 Poll identified as ARRL members.

Antenna Project Update
The antenna and 30 foot pole survived a significant trial of a recent windstorm with 50+ MPH bursts. I was able to finish routing the coaxial cable into N8GNJ Labs to within a few feet of the radio desk. Unfortunately, an urgent family issue has arisen requiring some cross-country travel, and it will be a few more weeks before I can finish the work.

Icom IC-905 Pokes its Head Out at HamCation 2023

… and presages at least six more weeks of development[1].

The Icom IC-905 is currently in development (not yet for sale). It is the first radio for the Amateur Radio market that incorporates 144 / 430-450 / 1240-1300 MHz, 2.x / 5.x GHz, and optionally 10.x GHz.

In contrast to all previous appearances of the IC-905, the unit shown at HamCation 2023 was touchable by the masses, and was at least semi-functional (could receive). Josh Nash KI6NAZ of Ham Radio Crash Course (YouTube) and Jason Johnson KC5HWB of Ham Radio 2.0 (YouTube) received briefings from Icom's Ray Novak N9JA.

Here are a few new'ish details from these videos, and other mentions from the IC-905's first "live" appearance:

- Projected release is "by end of year",
- Price is "not yet available",
- No "extended receive" capability; the frequency ranges are locked to Amateur Radio allocations for the specific market (presumably, versions for US, Europe, and Japan), including the overlap of Amateur Radio allocations and license-exempt spectrum (generally used for Wi-Fi) in 2.x and 5.x GHz.
- That said, a capability that's unique to the IC-905 is the ability to use *all 500 MHz* of the Amateur Radio 10.0 - 10.5 GHz band. Previous 10 GHz systems (using transverters) were limited to the bandwidth of the Intermediate Frequency (IF) of the primary radio; typically a 144-148 MHz radio, thus only 4 MHz at a time was usable. Thus, the IC-905's ability to use 10.0 to 10.5 GHz is an impressive new capability, unique to the IC-905.
- The same can be said for the IC-905's ability to use the Amateur Radio 2.39 - 2.45 GHz band (contiguous 60 MHz).

- Maximum bandwidth display on the screen is 50 MHz (-/+ 25 MHz).
- There is no dedicated external video connection (such as HDMI, DisplayPort, etc.). There was no mention if video output is available via the USB-C port.
- If you connect the optional CX-10G 2.x GHz to 10.x GHz transverter, you can still use 2.x GHz - 2.x GHz *or* 10.x GHz is *selectable*.
- There's no evidence of a dedicated output to activate external units such as transverters or power amplifiers, but that capability may exist on the control connector for the CX-10G; the detail of the signals on that connector hasn't been revealed.

Putting it in a backpack, N9JA seemed to subtly try to position the IC-905 as suitable for portable operations such as Summits on the Air (SOTA), or Parks on the Air (POTA), or microwave contesting. There was significant pushback to that scenario in the IC-905 mailing list and comments on YouTube, including:

- Power budget (how big a battery / power supply would you need?),
- Bulk of the "tower" unit. In fairness, the tower unit is far more compact than one transverter per band previously required for 2.x, 5.x, 10.x GHz capability,
- No option for a shorter cable between the control unit to radio unit,
- Weight of the entire system.

Satellite Capabilities - Nothing Mentioned (Yet)
It's puzzling to me that Icom *still* has not directly addressed (that I'm aware of) whether or not the IC-905 is usable for QO-100, despite its potential suitability for that use given its 2.x GHz (QO-100 uplink) and 10.x GHz (QO-100 downlink) capabilities.

Still, it's encouraging that between its "debut" at Hamvention 2022 (as a concept called SHF Project) and its official debut at (Tokyo) Hamfair as the IC-905, the CX-10G 10 GHz transverter appeared, perhaps in response to feedback that 10 GHz capability would make it more usable for QO-100…

and… perhaps the CX-10G makes the IC-905 more usable for the previously discussed "5 and Dime" geosynchronous satellites whose downlink will be at 10 GHz and uplink at 5 GHz. One indicator that "5 and Dime" compatibility was a design goal was the choice that the CX-10G is connected to the 2.x GHz portion of the IC-905 rather than the 5.x portion of the IC-905, and that both had dedicated antenna connections rather than a shared antenna connection.

For more details on "5 and Dime", see GEO! GEO!! GEO!!! in Zero Retries 0075 and Exploring the Idea of a Geostationary Amateur Radio Satellite for the Western Hemisphere in Zero Retries 0012.

It will be interesting to see the IC-905's next appearance at Hamvention 2023 in May.

The Inevitability of Digital *Everything* in Amateur Radio

Re: The Antennas(s) Problem in Zero Retries 0083, my friend Larry Gadallah NM7A commented:

> Regarding antennas: You are correct, there is the issue of the physical aspects of installing antennas versus the steadily increasing average age of the amateur population. But there's another factor to consider, which is the increasingly hostile EMI / RFI2 environment that most hams live in. Many amateurs, AFAIK, are in situations where they _could_ put in a bigger and better antenna, only to be rewarded with more noise.
>
> This is driving the notion of "remote ham radio", with it's attendant commercialization (i.e. you just rent someone else's station), and I gather the issue is getting serious enough that it is starting to affect non-amateur radio users too.

Larry - Not to discount your observation, but I think that the "increasingly hostile EMI / RFI environment" you note is one of the prices we humans pay for living more comfortably thanks to advanced technology. In my opinion, this isn't different in scope to no longer being able to assume that water from a forest stream won't be hazardous to drink without purification, not being able to see the full glory of the night sky due to urban light pollution and increasing numbers of low earth orbit satellites, litter along roadways, etc. Yes, we could do better, and arguably we should… but the reality is that we haven't, and likely won't, and (in my opinion) we need to adjust to that reality.

We first began to notice the "increasingly hostile EMI / RFI environment" perhaps a decade ago when inexpensive "wall wart" switching power supplies became ubiquitous, with the attendant noticeable rise in the noise floor in urban areas on the HF bands. But, we (and especially the 99+ % of humans who don't have Amateur Radio licenses) didn't stop using wall warts that use switching power supplies.

For me, the primary example of new technology creating noise on the HF bands is rooftop solar panels. As I understand it, rooftop solar panels have become more effective, more efficient, more easily installed, and less expensive from the inclusion of "micro inverters" with each panel. This made wiring the solar panels together easier, and thus less expensive overall. But, the hidden cost to having switching power supplies built into every solar panel is an increase of the "hostile EMI / RFI environment" that you noted… made worse by the solar panels being on rooftops and thus able to radiate much their interference "more effectively".

Even venerable broadcast AM radio is now endangered given the "hostile EMI / RFI environment" of battery electric vehicles.

Even knowing this, when the time comes in the next few years to equip my household with solar panels and a battery system, I'll do so with little consideration to potentially increasing the "hostile EMI / RFI environment" that will result from my new solar panels. The overriding "greater good" of the solar panels and battery system far outweigh the negatives of increasing the "hostile EMI / RFI environment".

Whither Analog Communications?

Unstated in the discussion of "increasingly hostile EMI / RFI environment" is that this issue primarily affects *analog* communications.

Digital communications are, by their nature, less affected (not immune… just *less* affected).

For the 99+ % of humans who don't have Amateur Radio licenses, the "increasingly hostile EMI / RFI environment" is almost entirely a non-issue, because almost all of *their* "radio" communications have long since (seamlessly) converted to digital. Example of this are mobile telephony has converted from analog to four (arguably) successive generations of digital communications. Analog landline telephony (suceptible to radio and powerline interference) has been replaced by nearly every individual having a mobile telephone. Cable television has long since converted entirely to digital modulation within the cable television distribution network. Over the air television (at least in the US) has converted to digital. Even public service and commercial two-way radio has converted to digital communications with the use of P25 (and FirstNET) and Digital Mobile Radio (DMR).

Broadcast AM radio might have survived the inevitable transition to battery electric vehicles if the broadcast AM radio industry had wholly embraced, at no additional cost to the consumer, a digital version of AM broadcast radio called HD Radio. But, the developers of HD Radio required a significant royalty for each HD Radio unit, so HD Radio is only available on higher-priced broadcast AM radio receivers.

In Amateur Radio, there are numerous examples of digital communications "shrugging off" the "increasingly hostile EMI / RFI environment", such as:

- WSJT-X, WISPR, and JS8Call work amazingly well on HF even with incredibly low Signal to Noise Ratios (SNR), in part because they incorporate Forward Error Correction (FEC).

- D-Star, DMR, YSF, FreeDV / CODEC 2, and M17 are all Digital Voice modes that, at least to some extent, work reasonably well despite the "increasingly hostile EMI / RFI environment". They also incorporate FEC.

- Traditional Packet Radio 1200 bps Audio Frequency Shift Keying (AFSK) is sensitive to noise, but new Packet Radio systems such as Dire Wolf3, and Dire Wolf's incorporation of two FEC systems - FX.25 and IL2P make traditional Packet Radio 1200 bps AFSK significantly more robust.

- VARA HF, VARA FM, Rattlegram / Ribbit, and other digital systems incorporate Orthogonal Frequency Division Multiplex (OFDM) techniques where the available channel is divided into subcarriers and each subcarrier is processed individually. Interference in one, or a few, subcarrier(s) may degrade communications, but the communication is usually successful. And, of course, they also incorporate FEC.

I understand the "mourning" of the loss of traditional analog modes on HF such as Single Sideband (SSB) analog voice. But instead of mourning these modes, perhaps Amateur Radio Operators should consider adapting to the new reality of "increasingly hostile EMI / RFI environment" by using newer digital modes such as FreeDV / CODEC2. On "modern" radios such as FlexRadio's 6000 series, adding FreeDV is a simple software install.

DLARC Notes

- **Archive for Amateur Radio Grows to 51,000 Items**
  This is a good article on Internet Archive's blog highlighting some of the significant content that DLARC has gathered and made available for public access. I have mentioned this milestone, but had not realized there was also an article written about it.

- **Packet-Radio Digest Archive**
  Packet-Radio Digest was a popular e-mail discussion list on the early Internet about packet radio. This collection archives all of the messages that have been found by the DLARC curator.
  I realize that it seems archaic now, but there was a time when "civilians" did not have access to the Internet. I only had access through "keyholes" such as a dialup Bulletin Board System that had an Internet connection via a local college. The Packet-Radio newsgroup, on the rare occasion I could access it, was a treasure trove of bleeding edge packet radio information… things that wouldn't appear in print media for months. Thus… this addition to DLARC is *cool*!

- **A Closer Look at Packet Radio**
  I actually saw a mention on social media (Facebook, perhaps?) that a person would like to get into Packet Radio and get a TNC, but they have no idea what a TNC is. We need good primary information sources like this article.

- **Advanced Amateur Radio**
  As *I* saw it as of 2001-07-04; not quite DLARC, but it is found on Internet Archive.

ZR > BEACON

- **Utah Digital Communications Conference 2023-04-29**
  You are invited to the 6th Annual Utah Digital Communications Conference held on April 29th, 2023, at the Salt Lake Community College Miller Campus in Sandy, Utah. This is a great one-day event to learn about digital modes and much more related to the Amateur radio hobby. We hope you will be able to join us for this event. Registration and schedule information can be found at: Utah-dcc.org For questions contact: utahdcc@gmail.com. Call For Proposals We are looking for presentations on all things digital in Ham Radio specifically presentations around using raspberry Pi or Arduino-type computers with ham radio. Hot Spots, DMR, D-STAR, HF digital modes, working satellites, Mesh, APRS, Winlink, building your own battery packs, etc. We will also have some display tables where you can display projects etc. With being later in the year weather permitting we will have space to set up your portable stations such as field day, GOTA, POTA, etc. Submit a presentation you can do or ask someone you know who has a great one to submit. Call for proposals

- **Radio Crystals - Still Available**

  The idea of having a separate crystal element in a radio to enable the use of a specific

frequency is so archaic now that I couldn't even find a Wikipedia reference.

There are still crystal-controlled radios in use in Amateur Radio, mostly for older radios used in repeater systems (which rarely change frequency). Another example is that I have a number of Kantronics D4-10 radios that are great radios, but require crystals for frequency selection. Thus, it's useful to know where you can still get custom crystal units to keep such radios going. From the repeater-builder mailing list, I discovered these two vendors (with recommendations)[4]:

- **Klove Electronics** - https://www.klove.nl/crystals/
- **KRYSTALY, Hradec Králové** - http://www.krystaly.cz/en/

- Open Research Institute (ORI) has published the February issue of their Inner Circle Newsletter. A few Zero Retries Interesting items were:
  - ORI's primary conference in 2023 will be DEFCON. *We have proposed an in-person Open Source Showcase to RF Village for DEFCON 31 in Las Vegas, Nevada, USA from 10 - 13 August 2023.*
  - *Amateur Satellite: ORI has the world's first and only open source HEO/GEO communications satellite program, called Haifuraiya.*
  - *Opulent Voice: a digital protocol that seamlessly combines high fidelity voice and data, using modern forward error correction, authentication and authorization, and efficient minimum frequency shift keying modulation.*
  - *Versatune: amateur digital television next generation hardware and software product.*
  - *HF QRP: Coming soon, an exciting HF QRP digital radio board and protocol.*

Feedback Loop

- Zero Retries 0085 Comments:
  Doug Pervine N1OBU *- My entire ham hobby has been focused on digital communications.*
  N1OBU also mentions using Dire Wolf, operating on 222 MHz, and LoRa.

Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, check out
Join the Fun on Amateur Radio for some pointers.

Zero Retries Frequently Asked Questions (FAQs) - In development 2023-02.

Closing the Channel

In its mission to highlight technological innovation in Amateur Radio, promote Amateur Radio to techies as a literal license to experiment with wireless technology, and make Amateur Radio more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to anyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex, which hides Amateur Radio content behind paywalls.

My ongoing ***Thanks*** to:

- Tina Stroh KD7WSF for, well, *everything!*
- Pseudostaffers Dan Romanchik KB6NU and Jeff Davis KE9V for continuing to spot, and write about "Zero Retries Interesting" items on their blogs that I don't spot on my own.
- Amateur Radio Weekly consistently surfaces "Zero Retries Interesting" stories.
- Andreas Spiess HB9BLA's YouTube channel - HB9BLA Wireless features Zero Retries Interesting content.
- Matthew Miller M0DQW's YouTube channel - Tech Minds features Zero Retries Interesting content. It's subtitled Ham Radio - SDR - RF Projects - Software - Tutorials.
- If you like the content of Zero Retries, I recommend Experimental Radio News by Bennet Z. Kobb AK4AV. ERN discusses (in detail) Experimental (Part 5) licenses issued by the US FCC.
- The Substack email publishing platform makes Zero Retries possible. I recommend it for publishing newsletters.

If you're reading this issue on the web and you'd like to see Zero Retries in your email Inbox every Friday afternoon, just click below to join ~~100~~ ~~200~~ ~~300~~ ~~400~~ ~~500~~ ~~600~~ *700*+ other readers:

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opens, clicking links, etc.

More bits from Steve Stroh N8GNJ:

- SuperPacket blog - *Discussing new generations of Amateur Radio Data Communications - beyond Packet Radio (a precursor to Zero Retries)*

- N8GNJ blog - *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs - Bellingham, Washington, USA*

Thanks for reading!
Steve Stroh N8GNJ / WRPS598 (He / Him / His)
These bits were handcrafted in beautiful Bellingham (The City of Subdued Excitement), Washington, USA.

2023-02-17

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1

For non-US readers, apologies for this subtle reference to the unofficial, but longstanding tradition of Groundhog Day.

2

EMI - Electromagnetic Interference; RFI - Radio Frequency Interference

3

Dire Wolf can receive packet radio transmissions more effectively than legacy packet radio systems because of its innovative "bit flip" technique to recover from single bit errors that would otherwise require a retransmission from the transmitting station.

4

Yes, there is at least one US vendor of crystals for radios, but there were some harsh words about that vendor in the discussion.